FIRE STATION STUDY FOR THE TOWNSHIP OF EAST WHITELAND, PENNSYLVANIA

EXECUTIVE LEADERSHIP

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An applied research project submitted to the National Fire Academy
As part of the Executive Fire Officer Program

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CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

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Abstract

This applied research project examined criterion used to properly locate fire stations. The problem was that East Whiteland Township is undergoing rapid development and growth. The intended purpose of this project was to examine the need for an additional fire station to increase the overall effectiveness of the department. In order to achieve this descriptive research was used to answer the following questions: What criterion have been established for fire station placement? What steps are needed to compile adequate information for this project? What resources are available to assist with identifying the need for an additional fire station? What benefits would be realized by adding an additional station?

Research, the review of various data and computer modeling were used, resulting in recommending potential fire station locations. Also recommended was the need for ongoing review of fire department deployment.

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Introduction

East Whiteland Township is a rapidly growing community located in Chester County, Pennsylvania, just west of the City of Philadelphia. The centralized location of this municipality has attracted a wide variety of office and industrial users. Many large businesses have selected East Whiteland Township for their headquarters. The growth of these businesses has caused a strain on the delivery of emergency response in a timely manner.

Community fire, rescue and ambulance service is provided by a combination fire department consisting of the East Whiteland Township Volunteer Fire Association and the East Whiteland Township Department of Codes and Life Safety. The Department of Codes and Life Safety augments the volunteer staffing with career firefighters around the clock to ensure that aid will be provided to the community. The current fire station was constructed in 1956, which, at that time, was within easy access to the majority of community. The problem is that East Whiteland Township is undergoing rapid development and growth. This growth is at the opposite end of the municipality from an existing station which is putting a strain on how effective and efficient emergency services are provided in the community.

The purpose of this applied research project is to examine the need for an additional fire station to increase the overall effectiveness of the department. Descriptive research will be utilized to answer the following questions:

1. What criteria have been established for fire station placement?

2. What steps are needed to compile adequate information for this project?

3. What resources are available to assist with identifying the need for an additional fire station?

4. What benefits would be realized by adding an additional station?

Background and Significance

East Whiteland Township was once a quiet community consisting of farm land, pockets of residential developments, limestone quarries. Business activity was limited to just a few areas. The construction of major highways linked the urban Philadelphia area with suburban Chester County. East Whiteland Township became a victim of "urban sprawl". Corporate Centers and large housing tracts were developed. Usable land became a valuable commodity. During this time the need for services (police, fire, EMS, public works, etc.) increased. The fire department evolved from a volunteer station responding to hundreds of incidents to a combination unit responding to thousands of calls annually. Throughout this period of growth, the East Whiteland Volunteer Fire Association operated from a single station, protecting the twelve square mile community as well as portions of a neighboring municipality.

The emergency calls for assistance are widespread throughout the area. Since the current fire station is located in the far western section of the municipality, parody of service is not available to those located in distant areas of the community. Response times vary considerable (under four minutes to over six minutes) to large areas of the community. Automatic aid from neighboring fire departments is used for structural fires. Response time from those agencies is dictated by the time of day, weather, travel distance.

Continued growth within the community is expected. Currently land development plans are being considered by the township that would substantially increase residential and commercial growth to the eastern section of the community.

This, along with the existing need for fire department services in that area, poses a serious threat to the health, safety and welfare of the community.

This Applied Research Project directly relates to the July 2005 Executive Leadership class held at the National Fire Academy. Unit 12: Influencing Styles outlined the importance of using influence strategies to have an edge when dealing with a difficult issue. Unit 13: Storytelling described the power of forming and telling a good story to influence others. The impact of this problem must be justified to the local elected officials by using the content of the Executive Leadership course.

This ARP directly relates to the United States Fire Administration's operational objectives. "To respond appropriately in a timely manner to emerging issues." (FEMA, 2004, II-2) By positively addressing this emergent issue in the fire service the overall effectiveness of the fire department will positively impact the community of East Whiteland Township.

Literature Review

Literature review was structured around the specific research questions, which created the path for this authors own collection of data and research.

Is there an established criterion for fire station placement? Gary (2001) indicated that at the time of his article there was no national deployment model. He then discussed the Commission on Fire Accreditation International's (CFAI) standard of cover (soc) process. According to Gary (2001) CFAI's deployment analysis brings together various data for better results. The work of Stallings (2002) identifies two other variables in the criterion mix; the Insurance Services Office (ISO) and the National Fire Protection

Association (NFPA). "ISO would like to see a fire station be located to provide a coverage area of one and one-half miles of travel distance." (Stallings, 2002, p. 44)

NFPA 1710 (2004) establishes critical time objectives for both fire and EMS related emergencies. The following objectives are for fire incidents; turnout time 60 seconds, first engine arrival within four minutes and full first alarm arrival within eight minutes. Similarly, EMS objectives are the arrival of a first responder or higher within four minutes and advanced life support arrival within eight minutes. All of these objectives are to be met at least ninety percent of the time.

NFPA 1720 (2004) identifies response times differently. Table 4.3.2 found with NFPA 1720 (2004) indicates that authority having jurisdiction (AHJ) shall determine the staffing and response time for special risk areas, but those requirements must be met ninety percent of the time. Urban areas must have fifteen firefighters arrive with a response time nine minutes or less ninety percent of the time. Suburban areas must have ten firefighters arrive with a response time within ten minutes eighty percent of the time. Rural areas must have six firefighters arrive with a response time fourteen minutes or less eighty percent of the time, and remote areas must have four firefighters arrive (no response time indicated) ninety percent of the time. All of these areas have a common bond, "upon assembling the necessary resources at the emergency scene, the fire department should have the capability to safely commence an initial attack within 2 minutes 90 percent of the time." (NFPA 1720, 2004, Table 4.3.2)

The work Schmidt (2003) identified three components; flashover, fire flow and response time to ascertain the necessity of additional fire stations. The flashover component links time, distance and resources together. Time has two components; the

time it takes a room to flashover and the time it takes until firefighters arrive and interrupt the flashover process. Schmidt (2003) indicates that "it takes about four minutes, on the average, give or take thirty seconds" (p. 16) for flashover to occur. The time required for a room to flashover can be indirectly managed. Automation fire detection and/or automatic fire suppression systems can help in managing this time segment. (Barr and Caputo, 2003) Fire flow has internal components as well. Is there enough water and pumping capacity available for extinguishment and are there enough firefighters to deliver the amount of water needed?

Schmidt (2003) determined that the appropriate response time for his department was 4.5 minutes which equated to 1.5 road miles. "A structure fire that burns uninterrupted for more than four minutes and thirty seconds will probably result in firefighters confronting a room fully involved, fires that have reached this stage pose more of a risk to our firefighters and the public." (Schmidt, 2003, p. 16) Barr and Caputo (2003) believe that the time it takes firefighters to respond from the fire station to the incident can be managed. Travel time can be reduced by choosing fire station locations closer to the incidents.

According to Barr and Caputo (2003) "nothing is more important than the element of time when an emergency is reported." (p. 7-311) Time and finance are factor that local decision makers must consider when deciding fire station locations. Barr and Caputo (2003) identify four items to consider; the service that the fire department provides, deciding on a reasonable travel time, size of the community and resources available and finally what level of risk is the community willing to accept.

Gary (2001) identifies that the CFAI soc process has eight components; existing deployment, community outcome expectations, community risk assessment, distribution study, concentration study, historical reliability, historical response effectiveness studies and overall evaluation. In order to effectively gather data for this project each of the components must be understood. "The determination of response capability should be based on local risk assessment…" (Coleman, 2001, p. 68)

Data sources must be determined and examined to verify there reliability. Strawderman (2000) points out that CAD information provides useful historical data, but may not provide all the necessary information to properly analyze the activity.

Barr and Caputo (2003) indicate that a community analysis should be completed to allow decision makers to review the results to determine the placement of fire stations. This research should include historical response data for fire and EMS, the level of service provided to the community, the level of care expected by the community and the expectation for service within the community. (Barr and Caputo, 2003)

Research conducted by Stallings (2002) concluded three findings regarding fire station location planning; use reliable software, develop a standard of cover policy and understand the effects of national standards on fire station placement. The San Jose Fire Department selected software from Deccan International to analyze their response data (CAD Analyst) and to create resource modeling (Fire ADAM). (Farnesworth, 2001) Another type of software available is RHAVE (Risk, Hazard and Value Evaluation) which was published by the Commission on Fire Accreditation International (CFAI) to support the standards of cover research. (Coleman, 2004) RHAVE was developed "to evaluate and score building risk." (Oliver, 2002, p. 5)

Oliver (2002) suggests that fire departments should begin to use the GIS (geographic information systems) technology. GIS is more than mapping, it is a planning tool. "The development of GIS mapping finally provided the fire and rescue service with the ability to model travel time and distance more accurately than the old method of circles or 'as the crow flies'". (Strawderman, 2000, p. 41) GIS combines multiple data sets and then visually displays them for everyone to examine. "A strategic GIS view of the community can help define station locations, realign response districts and identify target hazards such as flood plans, as well as locate water supply and high calls-for-service areas." (Oliver, 2002, p.1)

Fire station planning could open dialog within the municipal planning process. In San Jose (California) rapid growth strained the capabilities of the fire department (Farnsworth, 2001). This forced San Jose to develop a comprehensive plan to identify what resources were needed to meet the mission of the department. Farnsworth (2001) indicated that they "developed performance statements that let the community and the council evaluate and determine the appropriate level of fire protection and EMS." (p. 67)

"One of the primary responsibilities of a fire department is the delivery of fire and rescue services." (Barr and Caputo, 2003, p. 7-311) Fire grows many times it size every minute. If fire station locations are properly located response time will be reduced. "Time is a critical factor for the rescue of occupants and the application of extinguishing agent." (Barr and Caputo, 2003, p. 7-311) The community will benefit from a properly analyzed fire station location study.

Procedures

The desired outcome of this project was to gather enough appropriate information to determine if an additional fire station was needed within East Whiteland Township. The descriptive research was used to gather the necessary data to successfully complete this ARP.

Research for this project began at the Learning Research Center (L.R.C.) at the National Emergency Training Center in Emmitsburg, Maryland. A search was conducted for; "fire station planning", "fire station placement" and "standard of cover." A great deal of information was found contained within magazine articles, text materials and Applied Research Projects by other participants of the Executive Fire Officer Program. Since there was a vast array of information, research material was reviewed only if it was current (post 2000) and deemed useful to the project.

A similar search was conducted on the internet. A general search was conducted using the same search parameters as used in the LRC. Since much of the research collected from both the LRC and the internet referenced the CFAI's standard of cover process, this author purchased the "Creating & Evaluating Standards of Response Cover for Fire Departments" (electronic version) from the International Association of Fire Chief's.

Addition data directly related to this report was gathered from records retained by this author's municipality, East Whiteland Township. Information included; emergency response data, hazard vulnerability data and proposed land development projects that will begin in the near future. Hazard vulnerability was already included with East Whiteland Townships GIS, the information was verified as current and included with this project as

Appendix B. Pending land development projects were added as layer within the project, Appendix D. Current deployment (Appendix A) was then added as a layer into the project. Addition emergency response data was collected from the Chester County Department of Emergency Services (CCDES). CCDES serves and the 911 call center and dispatching center for the entire County. Computer Aided Dispatch (CAD) records were compared to local call data and determined to be the primary emergency response record data source for this project.

Call data was transferred to the GIS for a graphic depiction of recent events. Appendix C) The intention is that GIS be used as collection point for data that may be considered in the final results of this project. "The ability to plan future fire protection for a growing community is made easier with the use of GIS." (Oliver, 2002, p. 1)

Limitations:

This project had several limitations. One limitation that directly affects the final outcome is emergency response data. A great deal on importance is placed on time. Barr & Caputo (2003) along with others reference time as a measurement tool for studying data. Since time is a tool, then it must be recorded properly in order to have value within the data. Incomplete incident reporting records limited the effectiveness of plotting call data.

Another limitation was financial. The cost to obtain software that could interrupt data and than display the findings within the GIS was too prohibitive. The author did have the advantage of using the municipal GIS but most of the data had to be manually entered in to the system. GIS provides an excellent visual representation of data, but the full benefit is not realized within this report because of the paper size and color restraints.

Definition of Terms:

CAD – Computer Aided Dispatching

Fire Flow – The necessary volume of water needed to combat a fire.

Flashover – The point that all combustible materials within a fire area (room) ignite. Survival is unlikely.

Framing – The ability to formulate information so that the intended recipients are able to fully understand the data.

GIS - Geographic Information System

Remote Area – An area that require a travel distance of eight miles.

Response Interval – The amount of time it takes for a call-taker and dispatcher to process an incident, plus the turnout time, plus the travel time.

Rural Area - An area with less than 500 people per square mile.

Standard of Cover – "The deployment "coverage" for a given community or area." (Gary, 2001, p 66.)

Suburban Area – An area with between 500 and 1000 people per square mile.

Travel Time – The period beginning when an apparatus responds until it arrives on scene.

Turnout Time – The period from when the station and personnel are alerted of an incident until an apparatus responds.

Urban Area – An area with at least 1000 people per square mile.

Urban Sprawl – Rapid community growth from businesses moving from urban to suburban areas.

Results

Answers to Research Questions:

Question 1. What criteria have been established for fire station placement?

Based on the work conducted by Gary (2001) there is no national model for the deployment of fire equipment. A large majority of the material researched for this project included the Commission on Fire Accreditation International's (CFAI) standard of cover process. The CFAI's standard of cover process includes eight components. (Gary, 2001)

- Existing deployment
- Community outcome expectations
- Community risk assessment
- Distribution study
- Concentration study
- Historical reliability
- Historical response effectiveness
- Overall evaluation

The standard of cover process is on of the requirements for a fire department seeking accreditation through CFAI. (Coleman and Gary, n.d.) This systematic approach allows each local jurisdiction to define its own need based on a comprehensive approach. The purpose of the CFAI's standard of cover process is to provide a standardized method to effectively design and initiate an emergency response force for the community.

Other criterion methods include; National Fire Protection Association (NFPA) 1710 and 1720 and Insurance Services Office (ISO). ISO criterion for fire station

locations is based on travel distance, one and one-half miles of travel distance. (Stallings, 2002) NFPA 1710 (2004) concentrates on service delivery. Simply, all service areas are to expect the arrival of the initial fire fighting forces within four minutes and the arrival of the full assignment within eight minutes ninety percent of the time. NFPA 1720 (2004) breaks staffing and response times into five areas with the AHJ having the final determination regarding staffing and response times. However, all areas must begin the initial attack within two minutes of arrival ninety percent of the time. The following table was taken from NFPA 1720 (2004, Table 4.3.2)

Table 1

Staffing and Response Time

Demand Zone	Demographics	Staffing and Response Time	Percentage
Special Risks	AHJ	AHJ	90
Urban	>1000 people/mi.^{2}	15/9	90
Suburban	500-1000 people/mi.^{2}	10/10	80
Rural	<500 people/mi.^{2}	6/14	80
Remote	Travel dist ≥ 8 mi.	4	90

Question 2. What steps are needed to compile adequate information for this project?

In order to gather to proper data for this project, the components of the standard of cover process along with the corresponding data must be understood. An outline for the project must be completed to remain directed towards the intended purpose. Just as Strawderman (2000) pointed out, CAD information supply's valuable historical data, however give the needed information to conduct a study.

CAD data was obtained from the Chester County Department of Emergency Services and compared to the local incident reports. The fire reports provided little use in the area of response time data. The CAD data was determined to have more of the time related data. A data range was selected January, 2005 through August 2005. These data segment was used because that it was the only time period available. A quick glance at the data would not look extremely bad; the average call processing time of 27 seconds, a turnout interval of three minutes and ten seconds and a travel time average of four minutes and eleven seconds. These add up to an average response interval of seven minutes and twenty-two seconds. However, of the 453 fire/rescue incidents reviewed only 135 fell with the seven minutes and twenty-two seconds interval. The other 218 incidents are depicted within Table 2.

Table 2

Response Intervals for Fire/Rescue Incidents 1/05-8/05

Response Interval	# of Incidents	Response Interval	# of Incidents
< 5 Minutes	85	11 to 12 Minutes	15
5 to 6 Minutes	38	12 to 13 Minutes	11
6 to 7 Minutes	42	13 to 14 Minutes	10
7 to 8 Minutes	34	14 to 15 Minutes	6
8 to 9 Minutes	24	15 to 16 Minutes	8
9 to 10 Minutes	12	16 to 17 Minutes	2
10 to 11 Minutes	15	17 to 18 Minutes	1

Question 3. What resources are available to assist with identifying the need for an additional fire station?

Research has revealed many options from one extreme to another. Data could be simply gathered and reviewed or computer systems and software can be employed to streamline the process. Computers can be used to analyze data and create graphic modeling. (Farnesworth, 2001) Fire departments should be using GIS as a planning aid. GIS uses multiple data sets to visually display the findings on the screen or can be printed for distribution. "A strategic GIS view of the community can help define station locations, realign response districts and identify target hazards…) (Oliver, 2002, p.1) The East Whiteland Township GIS was used as the central data point. The municipal GIS has existing layers already devoted to emergency services such as; fire hydrant locations and

available flow, several layers devoted to special hazards and pending land development projects. "Potential sites can be examined using computer generated maps that show a service area in terms of time a distance." (Stallings, 2002, p. 44)

Three potential sites were located based on risk, call volume and expected growth. Each of the sites was then individually plotted on a map with the existing response time data. The mapping was created by using the municipal GIS. (Appendix's E, F & G)

RHAVE software has been used by East Whiteland Township for sometime. This process defines the structures fire risk and assigns an associated score; low, moderate, significant and maximum. (Gary, 2001) The scores of the buildings, or in most cases the area, have been transferred the municipal GIS to display the community risk.

Question 4. What benefits would be realized by adding an additional station?

All individuals residing within the municipality should be afforded the same services. Properly reviewed fire station will effectively distributed fire and rescue resources. "Time is a critical factor for the rescue of occupants and the application of extinguishing agent." (Barr and Caputo, 2003, p. 7-311)

Discussion

This applied research explored a topic that effected many organizations in the past and will undoubtedly touch many organizations in the future. Research has found varying levels of diversity when it comes to the proper placement of fire stations. Gary (2001) outlined the Commission on Fire Accreditation International's (CFAI) standard of cover process, which focused on eight components. The standard of cover process(soc) uses a systematic approach to ensure that deployment is effectively distributed. The soc

process is a must for those striving towards accreditation. However, many agencies do not have the personnel, time or financial ability to commit to this program. Stallings (2002) identified two other agencies that deal with deployment, the Insurance Services Office (ISO) and the National Fire Protection Association (NFPA). Two NFPA documents that were reviewed for this project were NFPA 1710 (2004) and NFPA 1720 (2004). The purpose of both is very similar except that 1710 deals with career fire departments and 1720 deals with volunteer agencies. Another author, Schmidt (2003) focused on three components that revolved around time; flashover, fire flow and response time.

Existing deployment (Appendix A) was plotted of the GIS showing to boundaries; a four minute response zone and a six minute response zone. These figures were determined based on the research conducted.

It is clear to this author that there are several functional methods to determine the proper fire station placement. Since East Whiteland Township is not afforded with a large staff or the ability to dedicate an individual to the standard of cover process information must be gleaned from all the available resource to effectively and efficiently come to an acceptable conclusion. The bottom line is; can the fire department arrive early enough and deploy an effective firefighting force to interrupt the flashover process?

The implications to East Whiteland Township from this project will benefit the community and the emergency responders for a long time. Research for this project uncovered poor emergency response records. When data was collected and reviewed regarding current emergency response times it was clear that incident information was being neglected. This process of inaccurate records was ceased and a new reporting

system was put into place. If the elected officials choose to approve the addition fire station many other implication must be dealt with including; funding, equipment and personnel.

In order for this project to be viewed favorably by the municipal elected officials it must be complete, understandable and have a positive impact to the community. "All good studies come packaged in a well-written staff report, presented by a credible fire chief, who, when backed up with significant facts about the community's risk and deployment performance, becomes a hard act to beat!" (Gary, 2001, p. 70) The United States Fire Administration outlined in the January 1, 2001 Statement of Purpose that the EFOP was designed to give Fire Service leaders "An understanding of the need to transform fire and emergency service organizations from being reactive to proactive; with an emphasis on leadership development, prevention, and risk reduction." (NFA, 2002)

Recommendations

The purpose of this research project was to examine the need for an additional fire station to increase the overall effectiveness of the department. The results of the research found various conclusions. Based on the supporting data; the current fire department deployment (Appendix A), hazard vulnerability survey (Appendix B), the emergency call data (Appendix C) and pending land development projects (Appendix D) it is clear that an additional fire station be constructed to improve the efficiency and effectiveness of fire, rescue and emergency medical services to the community of East Whiteland Township.

The location for this new safety resource should not be attempted without supporting data. Three proposed site were mapped, showing a proposed four minute and

six minute response time, using the municipal GIS. These sites were then overlaid onto the existing deployment map, appendix E, appendix F and appendix G. "Time is a critical factor for the rescue of occupants and the application of extinguishing agent." (Barr and Caputo, 2003, p. 7-311)

It is this recommendation that an addition fire should be situated within close proximity of that which was depicted with Appendix F (Site 2). Site 2 offers the community an equal distribution of resources.

Further more this author recommends that existing deployment be reviewed annually, at a minimum. To increase efficiency in this process an addition software program, FireView, is recommended for purchase. GIS applications are available and should be utilized in emergency planning.

References

Barr, R. C. and Caputo, A. P. (2003). *Planning fire station locations.* Fire Protection Handbook (Nineteenth Edition). Quincy, MA: National Fire Protection Association.

Coleman, R. J. (2001, February). Match your response to the problem. *Fire Chief*, 68.

Coleman, R. J. (2004, February). Self-Assessment more than a means to an end. *Fire Chief*, 34-35.

Coleman, R. J. and Gary, S. (Eds.). (n.d.). Creating and evaluating standards of response coverage for fire departments (Fourth Edition) [CD]. Chantilly, VA: Commission on Fire Accreditation.

Farnesworth, D. (2001, February). Standards of response coverage can be part of strategic planning. *Fire Chief*, 67.

FEMA, (2000). Executive Leadership, Student Manual. Emmitsburg, MD.

FEMA, (2002). Executive Fire Officer Program, Operational Policies and Procedures. Emmitsburg, MD.

Gary, S. W. (2001, February). System of cover. *Fire Chief*, 66-70.

National Fire Academy, (2002). Executive Fire Officer Program Operational Policies and Procedures. Emmitsburg, MD.

National Fire Protection Association. (2004, August). *Organization and deployment of fire suppression operations, emergency medical operations, and special operations to the public by career fire departments* (NFPA 1710). Quincy, MA: Author.

National Fire Protection Association. (2004, August). *Organization and deployment of fire suppression operations, emergency medical operations, and special operations to the public by volunteer fire departments* (NFPA 1720). Quincy, MA: Author.

Oliver, D. (2002, April 1). Atlas, arrayed. *Fire Chief.* Retrieved October 23,2005 from http://firechief.com/mag/firefighting_atlas_arrayed/.

Schmidt, R. (2003, February). *Preliminary study of a second fire station for Ellensburg, Washington.* Emmitsburg, MD: National Fire Academy, Applied Research Project.

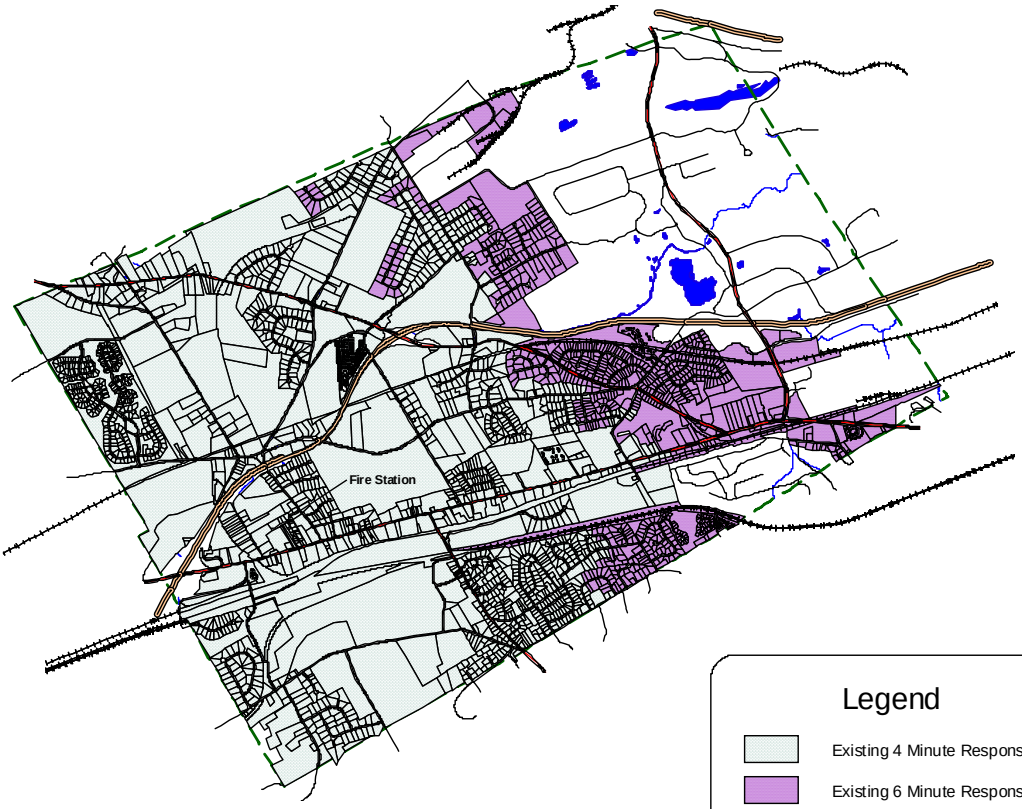
Stallings, J. W. (2002, September). *Determining fire station location for the city of Rocky Mount Fire Department.* Emmitsburg, MD: National Fire Academy, Applied Research Project.

Strawderman, S. (2000, March). *An evaluation of Prince William County Fire and Rescue station location sitting methods.* Emmitsburg, MD: National Fire Academy, Applied Research Project.

APPENDIX A

Existing Deployment

Existing Deployment



1 0 1 2 Miles

Legend

Existing 4 Minute Response

Existing 6 Minute Response

Roads

HIGHWAY

PRIMARY

SECONDARY

STREET

Railroads

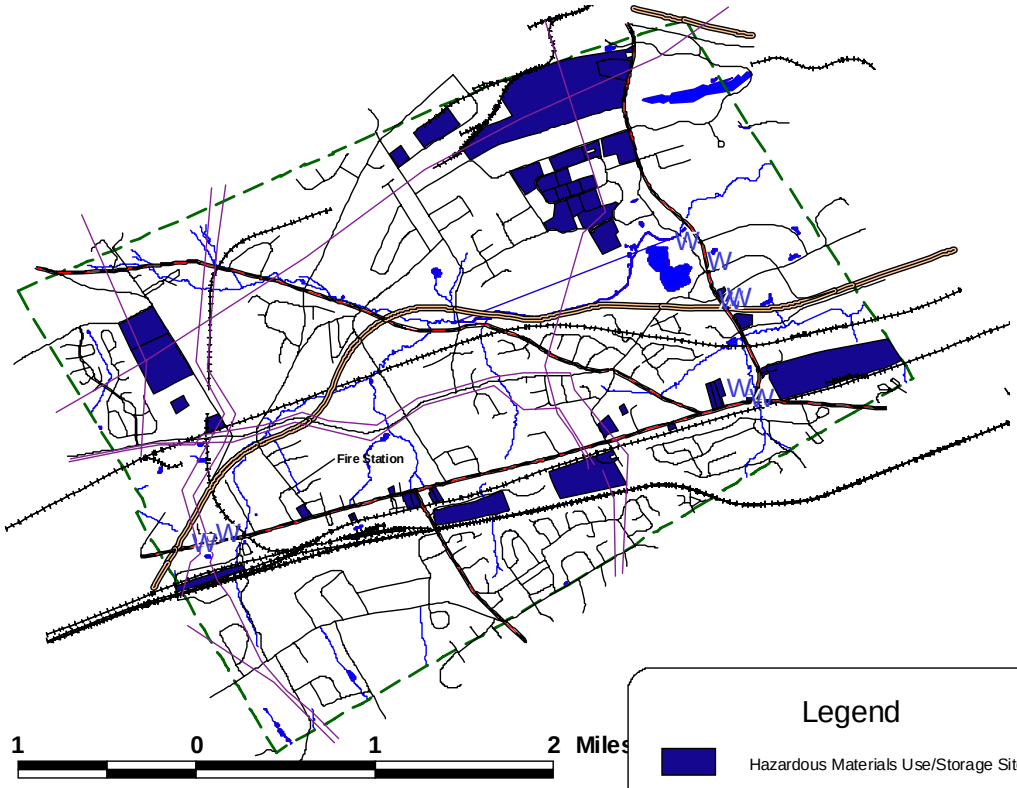
Streams

Lakes

APPENDIX B

Hazard Vulnerability

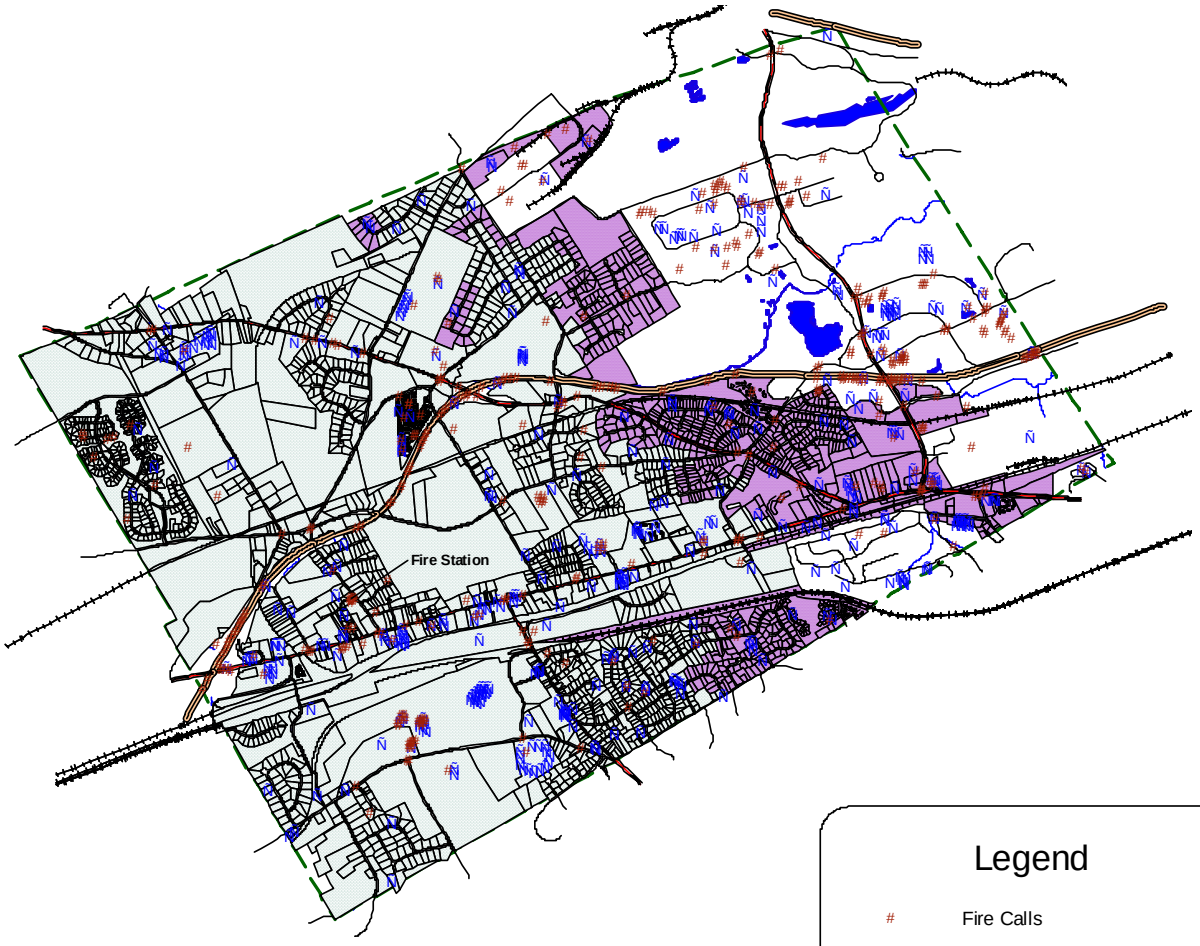
Hazards


Fire Station
1
0
1
2 Miles
Legend
Hazardous Materials Use/Storage Sites
Pipelines
W
Hotels
Roads
HIGHWAY
PRIMARY
SECONDARY
STREET
Railroads
Streams
Lakes

APPENDIX C

Emergency Responses
January 2005-August 2005

Emergency Responses
1/05 - 8/05



1 0 1 2 Miles

Legend

Fire Calls

Ñ EMS Calls

Existing 4 Minute Response

Existing 6 Minute Response

Roads

HIGHWAY

PRIMARY

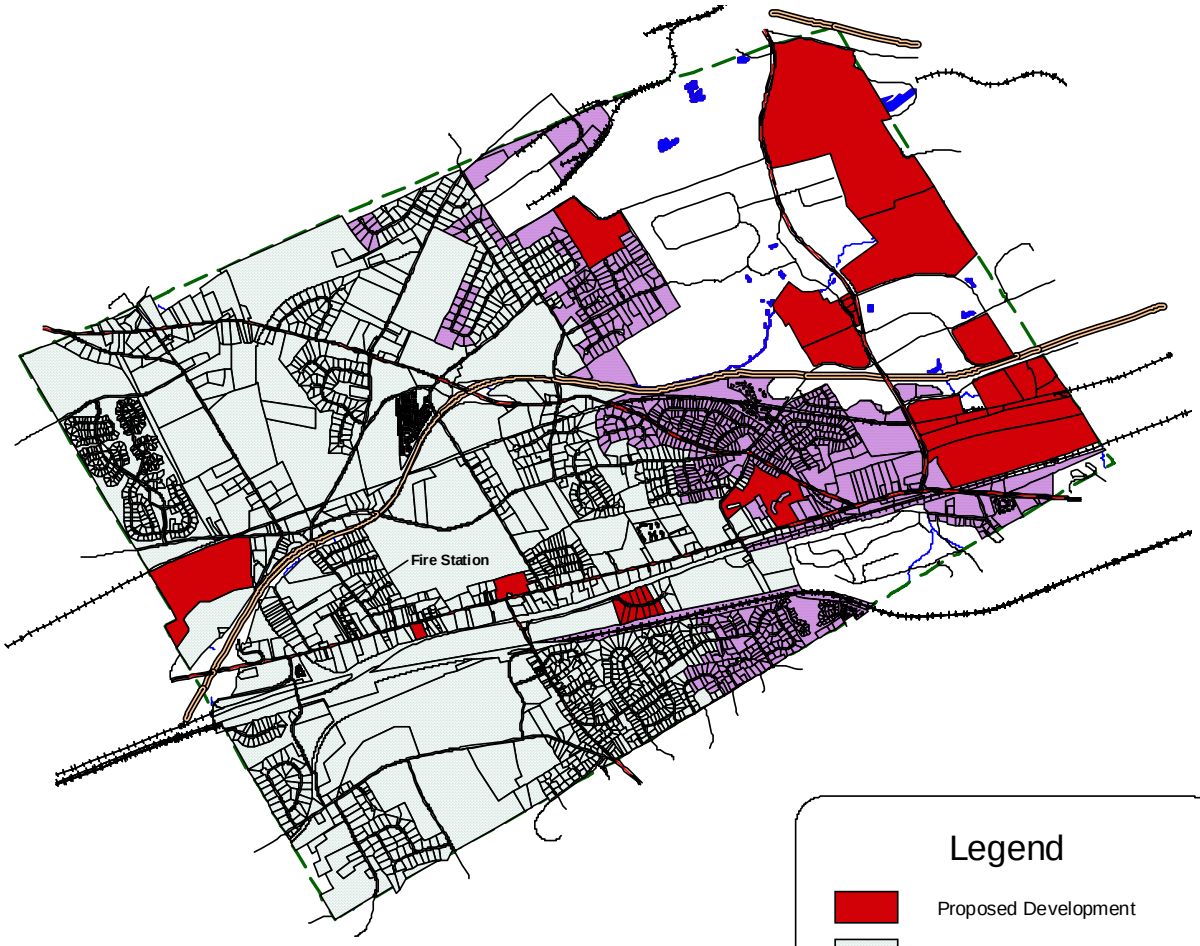
SECONDARY

STREET

APPENDIX D

Pending Land Development Projects

Pending Land Development



1 0 1 2 Miles

Legend

- Proposed Development
- Existing 4 Minute Response
- Existing 6 Minute Response

Roads

- HIGHWAY
- PRIMARY
- SECONDARY
- STREET
- Railroads

APPENDIX E

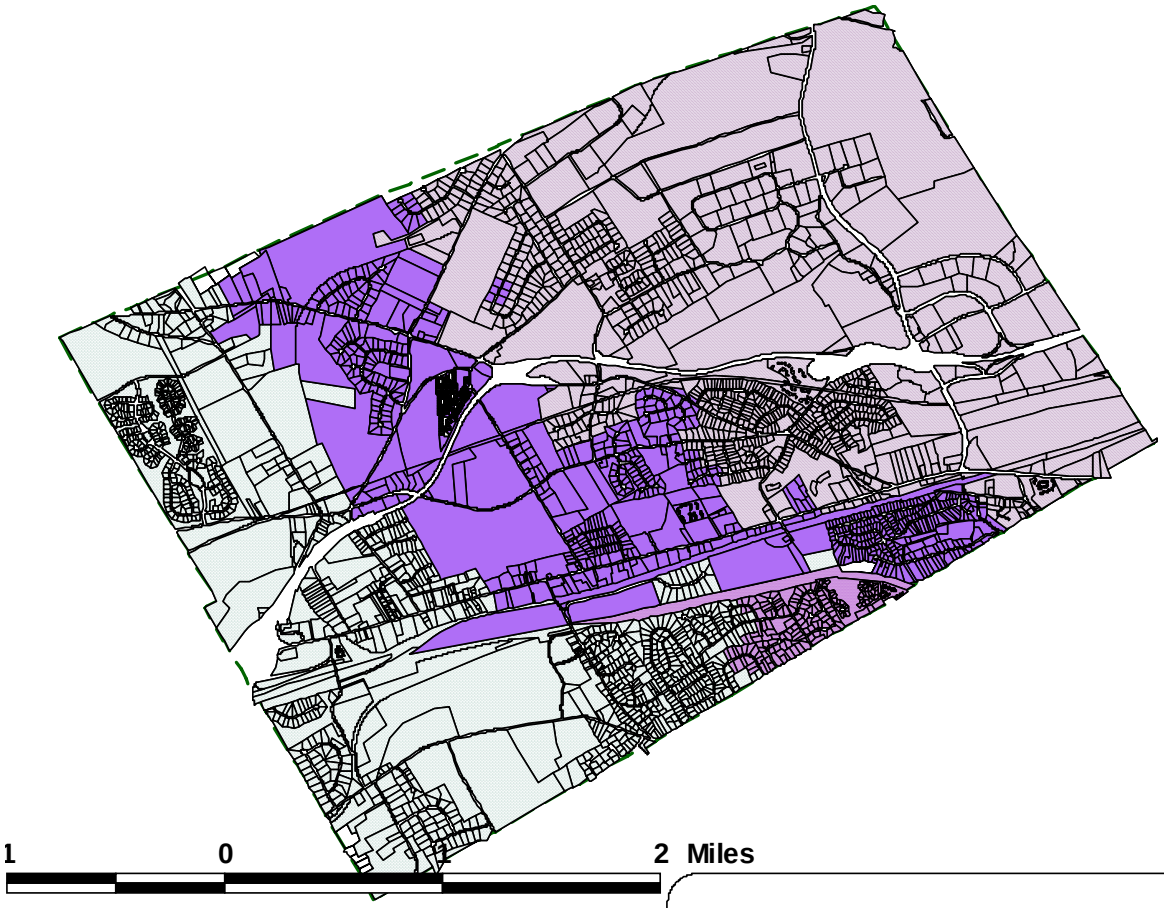
Proposed Fire Station Site 1

Proposed Station 2 Site 1

APPENDIX F

Proposed Fire Station Site 2

Proposed Station 2
Site 2



APPENDIX G

Proposed Fire Station Site 3

Proposed Station 2
Site 3